ISMI 2024 International Seminar on Mathematics in Industry 2024

Mathematical Evolution Guiding Industrial Innovation Futures

UTM Universiti Teknologi Malaysia

AISMM Akademi Ilmuwan Sains Matematik Malaysia (Malaysian Academy of Mathematical Scientists)

PROCEEDING

Roundtable Discussion

FORMULATION OF THE MALAYSIAN MATHEMATICAL SCIENCES POLICY: ISSUES AND CHALLENGES

9 September 2024
2:30 pm - 4:30 pm

Concorde Hotel Kuala Lumpur, Malaysia

More Information
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Organised by:
Center for Industrial and Applied Mathematics (UTM-CIAM)
Department of Mathematical Sciences, Faculty of Science, UTM

Co-organised by:
Akademi Ilmuwan Sains Matematik Malaysia (AISMM)

Supported by:
Asia Pacific Consortium of Mathematics for Industry (APCMfI)

Published by

Akademi Ilmuwan Sains Matematik Malaysia (AISMM)

Date of Publication: July 2025

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Preface

The Proceedings of the Roundtable Discussion on Malaysian Mathematical Sciences Policy, organized by AISMM and UTMCIAM, encapsulate a collective effort to address the critical role of Mathematical Sciences in shaping Malaysia's future. Through diverse perspectives, this volume brings together insights on the pivotal intersections between mathematical education & research, and industrial applications. These discussions provide a foundation for crafting policies that would elevate the role of Mathematical Sciences in Malaysia's national development.

The first presentation by Ibrahim bin Mohamed, examines Mathematical Sciences education in Malaysian primary and secondary schools. It identifies systemic challenges such as curriculum limitations, teacher quality, and the over-reliance on standardized assessments. Drawing inspiration from global leaders like Singapore and Finland, it recommends reforms in teacher training, curriculum design, and assessment methods to foster creativity and analytical thinking in students.

The second presentation by Hailiza Kamarulhaili underscores the importance of Mathematical Sciences within transdisciplinary STEM education. It highlights challenges such as declining enrolment in Additional Mathematics and persistent underperformance in international benchmarks like TIMSS. Proposals include reshaping the STEM curriculum, strengthening pedagogy, and integrating Mathematical Sciences more effectively with real-world and professional applications to prepare students for the demands of the modern workforce.

The third presentation, Mathematical Sciences Research: Challenges in Industrial Innovations by Arifah Bahar, sets the stage by highlighting the essential criteria for a robust Mathematical Sciences education. It emphasizes the need for balanced curricula, research excellence, and integration with industry to drive innovation. The presentation also calls for fostering public-private partnerships and ensuring inclusivity in Mathematical Sciences programmes, aiming to align academic pursuits with industrial demands.

Finally, in the fourth presentation by Norsarahaida Saidina Amin, Malaysia's journey toward becoming a high-tech nation is explored through the lens of mathematical excellence. From early industrialization policies to

contemporary initiatives like Industry-4WRD and the Shared Prosperity Vision 2030, Mathematical Sciences emerges as a cornerstone for technological advancement. This presentation advocates for transdisciplinary collaboration, robust institutional support, and a strategic curriculum framework to ensure Mathematical Sciences supports Malaysia's global competitiveness.

This compilation of presentations reflects the dynamic dialogue and shared commitment to shaping a Malaysian Mathematical Sciences Policy that supports national aspirations. It is hoped that these proceedings will inspire further collaboration and action to position Mathematical Sciences at the heart of Malaysia's sustainable growth and global innovation.

Editors:

Arifah Bahar (UTMCIAM)
Zainal Abdul Aziz (AISMM)

Challenges and way forward of mathematics teaching and learning in Malaysia Primary/Secondary Schools

Professor Dr. Ibrahim bin Mohamed
Institute of Mathematical Sciences
Faculty of Science
Universiti Malaya
Kuala Lumpur.

Abstract

This presentation explores into the current challenges and strategic paths forward for teaching and learning mathematics in Malaysian primary and secondary schools. The discussion highlights significant issues such as public perceptions, educational goals, curriculum design, assessments, and the quality of mathematics education. Critical factors impacting teaching effectiveness include teacher quality, motivation, professional development, and dedicated time with students. The presentation also addresses infrastructure, teaching resources, and the need for parent and external engagement.

Drawing comparisons with global education leaders like Singapore, Japan, and Finland, the presentation identifies gaps in Malaysia's system, including the reliance on standardized assessments and curriculum limitations. Recommendations include fostering partnerships, enhancing teacher training programmes, and modernizing the curriculum to promote creative and analytical thinking. This comprehensive analysis aims to align Malaysia's educational strategies with international standards to foster a more effective and inspiring mathematics learning environment.

ISMI2024 - International Seminar on Mathematics in Industry 2024

Roundtable Discussion: Formulation of the Malaysian Mathematical Sciences Policy - Issues and Challenges

Panel 1:
Challenges and way forward of mathematics teaching and learning in Malaysia Primary/Secondary Schools

Prof. Dr. Ibrahim bin Mohamed
Universiti Malaya

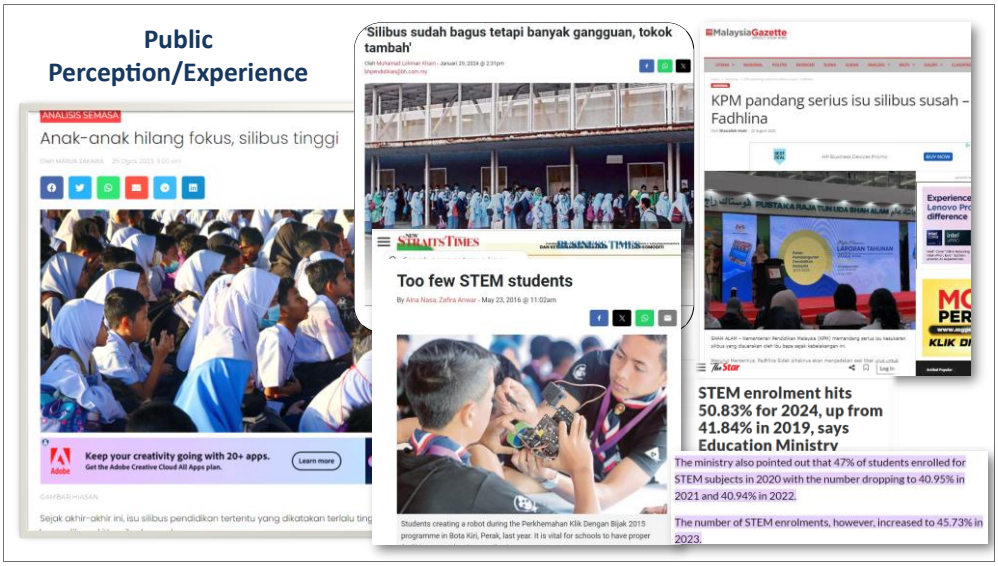
(Joint Work with Hashim, R., Ibrahim, A., Rosli, R. Azlan, M.I., Halim, S.A., Bakar, S.A., Noor, N.F.M and Siri, Z.)

9 September 2024
Concorde Hotel Kuala Lumpur

Issues

- **Public perception/experience**
- Goal/Objectives of mathematics teaching and learning
- Curriculum of mathematics subjects
- Assessment
  - National examination
  - Reflect quality of students
  - International ranking
- Pedagogy
- Critical factors:
  - Teachers' quality, motivation, personnel development and TIME with students
    - Opportunity for self-improvement
    - Teaching resources
    - Support from parents
    - Smart Partnership and External engagement
  - Ranking of schools
  - Facilities and learning environment
- Recommendation

Public Perception/Experience



Issues

- Public perception
- **Goal/Objectives of mathematics teaching and learning**
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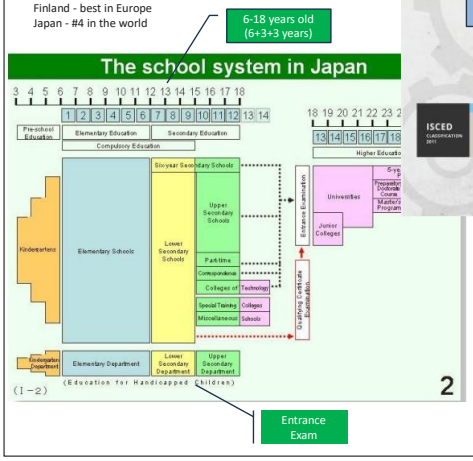
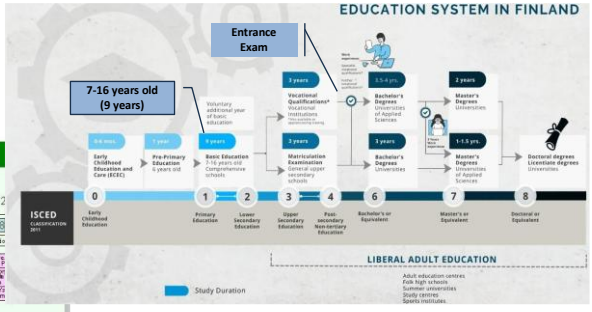
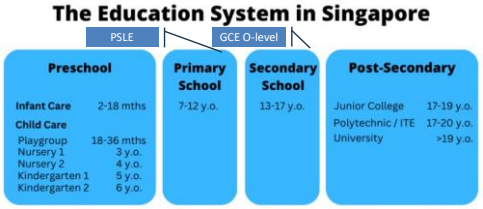
School system

Pisa 2022:
Singapore - top performer in all categories
Finland - best in Europe
Japan - #4 in the world







School assessment

Pisa 2022:
Singapore emerges top performer in all categories
Finland best in Europe
Japan - #4 in the world

SINGAPORE	Level
Primary School Leaving Examination (PSLE)	End of 6 years in primary school; English, Chinese/Malay/Tamil, Mathematics, Science
Singapore-Cambridge GCE O-level; To be replaced by Singapore-Cambridge Secondary Education Certificate (SEC) in 2027.	End of fourth year (Express stream) or fifth year (Normal academic stream) Removal of streams in secondary school in 2024.
Singapore-Cambridge GCE A-level	Upon completion of pre-university education at junior colleges. University entrance exam.

- **The first major gateway in Japanese schools is the entrance to upper secondary school, when students take entrance exams for admission. These exams are required nationally but developed by localities and schools.**
- **Japan has national assessments—the National Assessment of Academic Ability (NAAA)—in grades 6 and 9. These assessments are in mathematics, Japanese, and science, and since 2019, in English. NAAA was first administered in 2007 to a sample of students for the purpose of informing curriculum and policy planning.**

Assessment in Finland: A Scholarly Reflection on One Country's Use of Formative, Summative, and Evaluative Practices

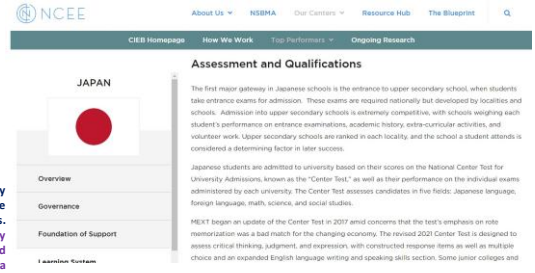
KATIE A. HENDRICKSON
Ohio University

Finland's high test scores have prompted international comparisons of educational policy. This article explores the use of assessment in Finland, particularly the intended use of student assessment and evaluation of schools as described in the National Curriculum. This article explores Finnish educational policy through the lens of formative and summative assessment in attempt to gain further understanding of the differences between Finland and the United States.

Finland has recently received international attention for its students' high performance on the Programme for International Student Assessment (PISA). Every three years, the PISA is administered to 15-year-old students in approximately 57 countries (Kupiainen, Hautamaki, & Karjalainen, 2009). Finland has scored first or second in mathematics on the past four

"Finnish students do not take a national, standardized high-stakes test until they matriculate secondary school and then only if they intend to enter higher education. Instead, the purpose of assessment in Finland is to improve learning"

https://ncee.org/country/japan/#:~:text=Japan%20has%20national%20assessments%E2%80%94the,informing%20curriculum%20and%20policy%20planning.



Mathematics learning goal/objectives

Malaysia:

- Fundamental principles of its National Education Philosophy 2013-2025
  - Focuses on the holistic development of individuals who are "intellectually, spiritually, emotionally, and physically balanced and harmonious, based on a firm belief in and devotion to God.
- The primary mathematics curriculum aims to **develop students**' conceptual understanding of numbers, basic calculation skills, understanding of simple mathematical ideas, and competence in applying mathematical knowledge and skills effectively and responsibly in daily life.
- Mathematics at the secondary school level aims to **develop individuals** who have mathematical competence. A mathematically competent individual is able to think mathematically, creatively, and innovatively, as well as apply mathematical knowledge and skills effectively and responsibly to solve problems and make decisions when dealing with challenges in their daily lives

Japan:

- **Enjoying mathematics** is an objective at the primary and lower secondary level, while **fostering creativity in mathematics** is an objective at the upper secondary level.
- The overall objectives for mathematics at the primary school level (Grades 1 to 6) are to use mathematical activities to accomplish the following: to **help** students acquire basic and fundamental knowledge and skills regarding numbers, quantities, and geometrical figures; **foster** students' ability to think logically and express themselves clearly about everyday matters; **help** students find pleasure in mathematical activities and appreciate the value of mathematical approaches; and encourage students to use mathematics in both their daily lives and their learning.
- The overall objectives for mathematics at the lower secondary level (Grades 7 to 9) are to use mathematical activities to do the following: **help** students deepen their understanding of fundamental concepts, principles, and rules regarding numbers, quantities, and geometrical figures; **help** students acquire skills in mathematical processing and representation so that they can develop their ability to analyze and represent phenomena mathematically; **help** students enjoy mathematical activities and appreciate the value of mathematics; and **encourage** students to apply their mathematical understanding and ability when they think and evaluate.

Singapore:

- Emphasize the **development of students**' mathematical abilities, with a focus on problem solving.
- The curriculum is designed in a spiral manner where concepts and skills in each content strand are revisited and built upon at each level to achieve greater depth and understanding.

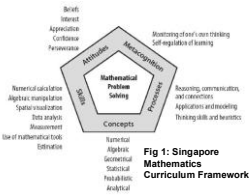


Fig 1: Singapore Mathematics Curriculum Framework

Finland:

- According to the National Core Curriculum for Basic Education, the purpose of mathematics instruction is to **support the development** of students' logical, precise, and creative mathematical thinking
- The Finnish Core Curriculum for Basic Education dictates mathematics contents in three periods.
  - Grades 1 and 2: **offers diverse experiences** via concrete tools, speech, writing, and drawing and interpreting images that help create a basis for the formulation of mathematical concepts and structures.
  - Grades 3 to 6: **builds students' understanding** of mathematical concepts and structures, and **develop students' skills** in presenting their mathematical thinking and solutions to others in different ways and with the help of different tools. In addition, solving a wide range of problems independently and in a group and comparing different solutions are essential.
  - Grades 7 to 9: **strengthens general knowledge and ability in mathematics**, and deepen students' understanding of mathematical concepts and the connections between them. Instruction guides students to mathematical modeling and problem solving and encourages discovering and using mathematics in their own lives. Mathematics instruction includes goal-oriented, precise, focused, and persistent activity. Presentations and discussions about students' solutions are desirable, and students' teamwork skills are developed.
- Education providers and schools may elaborate more a detailed curriculum **for themselves**

Mathematics school curriculum – Grade 1-4

Malaysia (Grade 1-4)	Japan (Grade 4)	Singapore (Grade 1-6)	Finland (Grade 3-6)
Numbers and Operation	**Number and Calculation**	**Number**	**Number and operation**
Whole number up to 100,000	Understand round numbers and appropriate contexts for using them; four basic operations, add and subtract using a *soroban* (Japanese abacus).	Whole numbers; four basic arithmetic operations, **Calculation with calculators**; Ordering of numbers; Approximation and estimation; Factors and multiples	basic mental arithmetic operations; properties of operations and the connection between them; **mastery of the 1 to 10 multiplication tables**; Rounding off figures; approximation and estimation of results;
Fractions	Fraction and basic operation involving fraction	Fraction and basic operation involving fraction	Fraction and basic operation involving fraction
Decimals	Decimals and basic operation involving decimals	Decimals and basic operation involving decimals	Decimals and basic operation involving decimals
Percentages		Percentage, Ratio	Percentages; Connection with fractions, decimal numbers
Money		Speed	Negative numbers
Measurement/Geometry	**Quantities/Measurement/Geometric Figures**	**Measurement/Geometry**	**Geometry**
Time		Measurement of length, mass, volume, time, and angle.	Building/drawing/examining/classifying objects and figures; Prisms/cylinders/cones/pyramids and their properties.
Measurement	Unit of measurement for area; determine areas of geometrical figures; understand the meaning of units and measurements for angles and measure angles	Area and perimeter of triangles, squares, and rectangles, area and circumference of circles, and volume of cubes and cuboids	Accuracy; estimating and verifying measurements; circumferences and areas of different shapes and the volumes of rectangular prism; conversion.
Shapes and spaces	plane figures (e.g., parallelograms, rhombuses) and solid figures (e.g., rectangular parallelepiped) and their elements.	Properties of simple geometric figures, Nets of simple solids, Line symmetry	concepts of a point/line segment/angle; drawing/measuring/ classifying angles; symmetry; noticing rotational and translational symmetries in surroundings—for example, in art.
Relationships/Algebra	**Mathematical relations**	**Algebra**	**Algebra**
Coordinates and proportion	relationships between two numbers or quantities; algebraic expression	Algebraic expressions in one variable	Observing regularities of sequences; the concept of the unknown; examining/solving equations by reasoning/ experimentation
Statistics and Probability		**Statistics and Probability**	**Data Processing/Software/Statistics and Probability**
Data handling	Gather/organize data; represent data using tables/graphs; explore the features of data.	Picture graphs, bar graphs, tables, line graphs, and pie charts (including interpretation/suggestion), Average.	Collecting data; Recording/presenting data in tables/diagrams. Minimum/ maximum values/average/mode; Probability in everyday situations.
			Thinking Skills and Methods
			Enhancing students' skills in finding similarities etc; systematically searching for alternatives; observing causal relationships/connections; Graphic programming environments are used

Mathematics teaching pedagogy – Finland

Facts	Detail
Class vs Subject teachers	First six years of comprehensive school, the children are taught by a class teacher, who generally teaches all or at least most subjects
	Last three years, the different subjects are taught by specialised subject teachers.
Learning usually takes place in **heterogeneous groups**.	Mathematics class sizes were among the smallest in the OECD countries (the mean was 18 students)
	The comprehensive education calls for a **flexible, school-based and teacher-planned curriculum** along with **student-centred instruction, counselling and remedial teaching**.
	Every student also has a right to **student counselling**. At grade levels 7 to 9, every school has a student counsellor, who provides individual guidance to those in need or desirous of it
Qualification of teachers	• The **university-level teacher** education was implemented in 1974. • The objective of teacher education has been to educate pedagogically thinking teachers who are able to think reflectively ove r their teaching.
	• **Mathematics is studied at the Department of Mathematics** and pedagogical studies at the Department of Teacher Education and in the Teacher Training School

Teachers have also been trusted as **true professionals** of education	• Finnish teachers have considerable pedagogical independency in the classroom. Within the limits of the national core curriculum, they make own decisions related to:
	  • the conduct of the teaching and learning process,
	  • developing the local curriculum,
	  • choosing teaching methods and
	  • selecting learning materials to be used.
	• Assessment is based mainly on the summative tests but also some formative tests and the teacher's observations during instruc tion.

Teaching practices in mathematics	• Typical mathematics lessons in Finland include teacher's instruction and students' own working in different forms and mathematics textbooks.
	• Teaching heterogeneous student body in mathematics presupposes small teaching groups and possibilities to re -organise groups if necessary,
	• The final assessment takes place twice a year after the autumn term and the spring term and then pupils will have their school report,
	• Mathematics teachers have actively sought for alternative and more pupil-centered methods in their teaching.
	  • Mathematical modelling, activity tasks, learning games, problem solving, investigations and project work.
	  • **Explanations, argumentations and lively discussions** are also more common during the Finnish mathematics lessons.

Equality achievement in mathematics	• The Finnish strategy for improving education is based on the principle of equity, and particularly on an effort to minimise low achievement.
	• Findings from PISA 2003:
	  • The gap between high and low performers : relatively narrow (mathematics literacy - standard deviation 84, lowest among OECD countries)
	  • The number of low performers : significantly smaller in Finland (7%) than it was in the OECD countries on average (21%)
	  • The lowest scoring students performed better than their fellow students in the other OECD countries.
	  • Small between-school variation are also observed, as students follow non-selective education systems.

Issues

- Public perception
- Goal/Objectives of mathematics teaching and learning
- Curriculum of mathematics subjects
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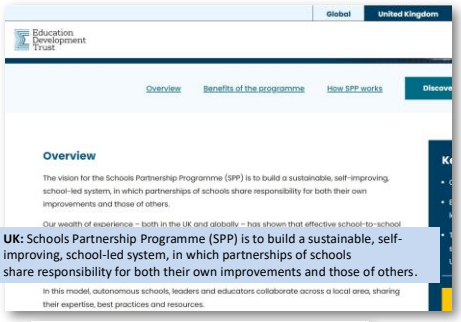
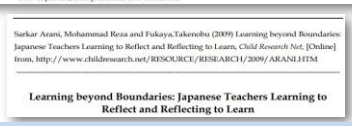
  - International ranking
- Pedagogy
- **Critical factors:**
  - **Teachers' quality, motivation, personnel development and TIME with students**
    - **Opportunity for self-improvement**
    - **Teaching resources**
    - **Support from parents**
    - **Smart Partnership and External engagement**
  - **Ranking of schools**
  - **Facilities and learning environment**
- Recommendation

Teachers' quality, motivation, personnel development and TIME with students

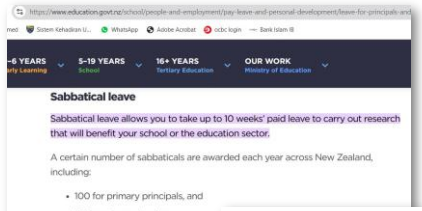


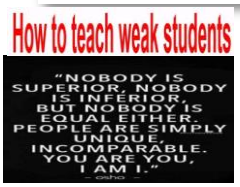
UK: Schools Partnership Programme (SPP) is to build a sustainable, self-improving, school-led system, in which partnerships of schools share responsibility for both their own improvements and those of others.


Sarkar Arani, Mohammad Reza and Fukaya,Takenobu (2009) Learning beyond Boundaries: Japanese Teachers Learning to Reflect and Reflecting to Learn, *Child Research Net*, [Online] from, http://www.childresearch.net/RESOURCE/RESEARCH/2009/ARANI.HTM

Learning beyond Boundaries: Japanese Teachers Learning to Reflect and Reflecting to Learn

Kaizen is the heart of lesson study process, and through it, teachers learn from each other to share ideas and to improve quality of their teaching in practice. These collaborative and intellectual activities provide teachers with learning community opportunities to raise level of their professional skills





Let Admin Officer does admin works....
And Technician attends technical needs...

Facilities

Bekas pelajar SMK Semerah serah komputer

Are Land
tak minta bnyk,, satu bilik guru letak la satu je komputer yg canggih, siap dgn printer.. siap dgn mesin fotostat, yg sentiasa dipantau oleh ppd kalau ada kerosakan,, satu tu pon dah bersyukur sgt2 dah.

Noor Ashyfida
Mohon beri yang BERKUALITI, laju, dan beri bajet juga utk maintenance (ni paling penting)..

Sebelum ni sekolah pernah dapat printer sewa beli, mmg bagus dapat laser, tapi sayang.. toner nya mahal ya rabbi, siapa lah yang mampu beli.. kna collect duit cikgu lagi ke?

اذلن بهرالدين
Rasanya jd kerja guru nak menjaga bnda2 ni smua.....

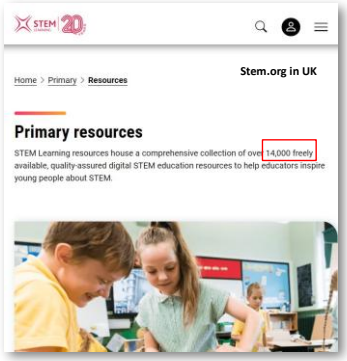
Cikgu Napi
Beri perhatian juga pada masalah internet di sekolah, semua kemudahan yg disediakan tidak dpt berfungsi secara optimum kerana line internet bermasalah.

Mohd Ikram Jabilin
Lebih baik minta data sekolah yg tiada makmal komputer dan cukupkan komputer at least boleh tampung 1 kelas... Lagi manfaat kepada pelajar.. Saya guru ASK, makmal komputer pun tidak lengkap

Huan Kee Kian
Sekolah2 yg serba kekurangan kena tanya diri sendiri adakah pihak sekolah buat permohonan dgn disertakan kertas kerja permohonan kepada pihak2 yg bertanggungjawab??? Setiap tahun semua sekolah bantuan penuh perlu mengigi borang serta memohon projek2 baikpulih kemudahan sekolah dll. Utk projek kecilan, tugas PPD utk settle tapi utk projek besar, PPD akan kemujakan ke JPN dan kemudian ke Kementerian. Ada ikut prosedur nin tak ?????

Teaching Resources

https://www.stem.org.uk/primary/resources



Sample 1

Sample 2

https://www.towson.edu/fcsm/centers/serc/

A key goal of this resource center:

- **To support the school-based STEM teaching of Towson's preservice teachers.**
- **To support course reform**
- **To make this equipment available to any Baltimore City or Baltimore County teacher who is affiliated with Towson University**

Hafiz Vincent Tan
Pendigitalan bukan setakat bagi laptop. Laptop medium akses... Bahan bahan pengajaran dan pembelajaran tu perlu digital kan. Perbanyakkan bahan Perbanyakkan platform perkongsian bahan. Jelaskan maksud Pendigitalan. Apa yg digital kan? Develop digitalis material is more important, providing the content. Perkasakan Delima ke.

https://stem.org.my/

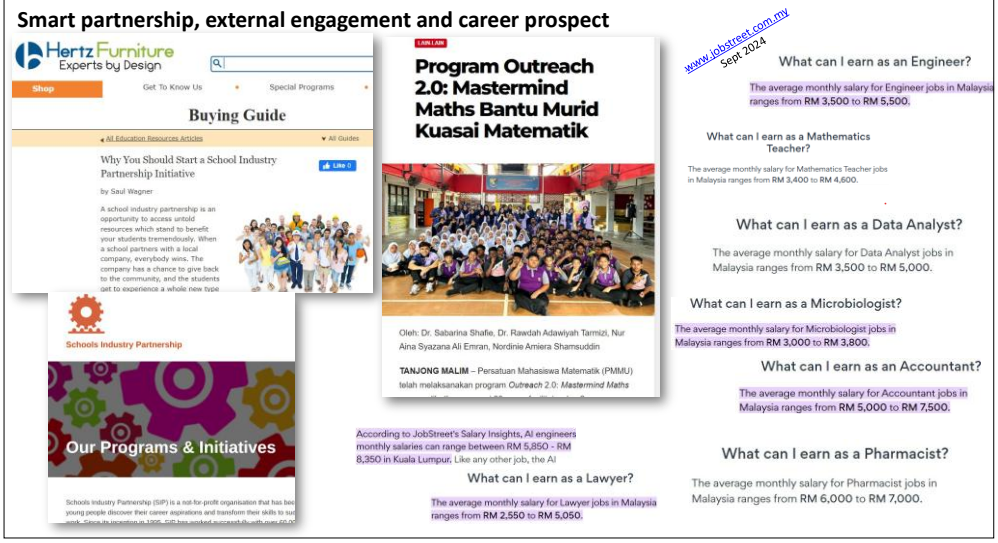
Drive the interest…

Mathematics is the only infinite human activity – Paul Erdos

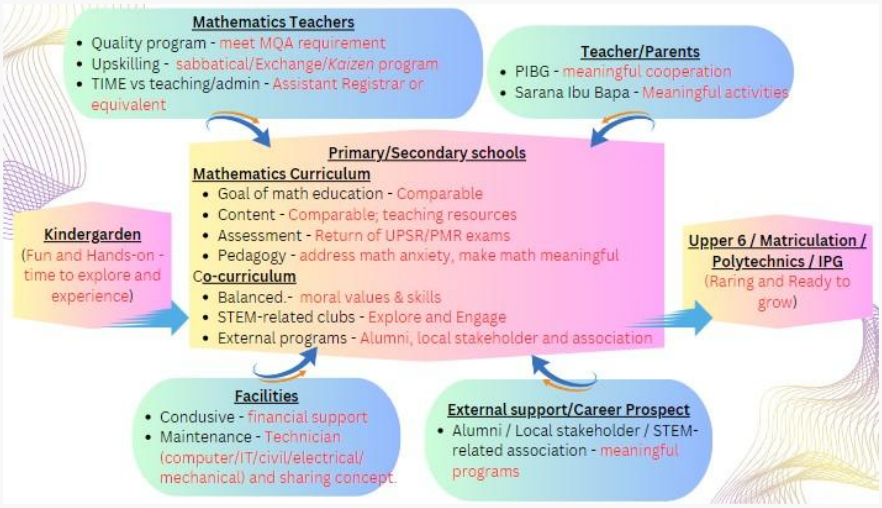
Board Of Engineers Malaysia
http://bem.org.my PDF

MoE: Programme with scientists in schools to attract students' interest in STEM

Smart partnership, external engagement and career prospect



Mathematics Education Ecosystem in Government School



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- **Recommendation**

Recommendation

Teachers and Parents

- A comprehensive re-look at the teacher training modules to ensure the **mathematics content** are equivalent and relevant.
- A comprehensive planning for career development and upskilling opportunities of **mathematics teachers.**
- Bring back the focus of mathematics teachers to teaching/mentoring/empowering students toward excellence.
- Let the Admin officer and Technical staffs to support TnL and lead the organization of non-academic activities.
- Meaningful contribution and programs involving PTA in particular and parents in general for students' success.

Curriculum & Co-curriculum

- A comprehensive study on the suitably of the present mathematics syllabus for primary and secondary schools with the other developed countries.
- A comprehensive re-thinking on the dynamic of students/school assessment approach to produce holistic mathematics students.
- A comprehensive plans for co-curriculum activities to strengthen students' interest in learning mathematics.

Facilities

- A minimum requirement of classroom/computer laboratory that are conducive towards TnL.
- Simpler and more practical guideline on generating fund from different sources of fund to maintain/improve the facilities.
- A platform for better collaboration with alumni/local stakeholder.
- Implementation of sharing IT/Technical staffs with neighboring schools.

Thank you

Repositioning Mathematics within Transdisciplinary STEM Education

Professor Dr. Hailiza Kamarulhaili
School of Mathematical Sciences
Universiti Sains Malaysia
Penang.

Abstract

This presentation explores the crucial role of mathematics within the context of transdisciplinary STEM education in Malaysia. It outlines the current structure of the upper secondary STEM curriculum, the distribution of core and elective subjects, and student enrolment trends in key subjects like Additional Mathematics. Despite recent efforts to boost STEM participation, issues such as declining enrolment in Additional Mathematics and concerning failure rates persist.

An analysis of international benchmarking, such as TIMSS (Trends in International Mathematics and Science Study), reveals that Malaysian students have underperformed compared to their peers in neighboring countries since 1999. This underperformance raises questions about the current curriculum's ability to provide students with a robust mathematical foundation and real-world problem-solving skills.

The presentation addresses the need to reshape the STEM curriculum to better integrate mathematics as a central, collaborative discipline within transdisciplinary education. This repositioning aims to enhance students' mathematical competence and prepare them to apply mathematical knowledge effectively in various real-life and professional scenarios. Solutions proposed include curriculum reform, strategic pedagogical adjustments, and strengthened emphasis on connecting Mathematical Sciences with industry and community.

REPOSITIONING MATHEMATICS WITHIN TRANSDISCIPLINARY STEM EDUCATION

by
PROFESSOR DR. HAILIZA KAMARULHAILI
SCHOOL OF MATHEMATICAL SCIENCES
UNIVERSITI SAINS MALAYSIA

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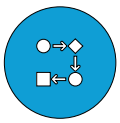
Upper Secondary STEM Curriculum in Malaysia: Facts and Figures


Students Enrolment in Additional Mathematics at SPM level


Mathematics Achievements in TIMSS


Issues and How to move Forward: Open for Discussion

STEM Education in Malaysia

- ***Kurikulum Standard Sekolah Menengah***(KSSM) was introduced in 2017 in stages starting from form 1.
- KSSM was initiated to replace KBSM (*Kurikulum Baru Sekolah Menengah*) that was introduced in 1989.
- Education Blueprint 2015-2025 has highlighted the need for a paradigm shift in our education system and as a result, KSSM had its way to replace KBSM.

Group of Subjects for Upper Secondary

CORE SUBJECTS (MATA PELAJARAN TERAS)	COMPULSORY SUBJECTS (MATA PELAJARAN WAJIB)	ELECTIVE SUBJECTS (MATA PELAJARAN ELEKTIF)
- Bahasa Melayu - Bahasa Inggeris - Sains - Matematik - Sejarah - Pendidikan Islam/Pendidikan Moral	- Pendidikan Jasmani & Pendidikan Kesihatan	- Bahasa - Pengajian Islam - Kemanusiaan & Sastera Ikhtisas - STEM

STEM Elective

PURE SCIENCE AND ADDITIONAL MATHEMATICS (SAINS TULEN DAN MATEMATIK TAMBAHAN)	APPLIED SCIENCE AND TECHNOLOGY (SAINS GUNAAN DAN TEKNOLOGI)	VOCATIONAL (VOKASIONAL)
- FIZIK /PHYSIC - KIMIA/CHEMISTRY - BIOLOGI /BIOLOGY - MATEMATIK TAMBAHAN/ADDITIONAL MATHEMATICS	- SAINS TAMBAHAN - GRAFIK KOMUNIKASI TEKNIKAL - ASAS KELESTARIAN - PERTANIAN - SAINS RUMAH TANGGA - REKA CIPTA - SAINS KOMPUTER - SAINS SUKAN - PENGAJIAN KEJURUTERAAN AWAM - PENGAJIAN KEJURUTERAAN MEKANIKAL - PEN. KEJ. ELEKTRIK & ELEKTRONIK - LUKISAN KEJURUTERAAN	- PRODUKSI REKA TANDA - HIASAN DALAMAN - KERJA PAIP DOMESTIK - PEMBUATAN PERABOT - REKA BENTUK GRAFIK - PRODUK MULTIMEDIA - KATERING & PENYAJIAN - GERONTOLOGI ASAS & GERIATIK - PENDAWAIAN DOMESTIK - MENSERVIS PERALATAN ELEKTRIK DOMESTIK - MENSERVIS AUTOMOBIL - KIMPALAN ARKA & GAS - MENSERVIS MOTOSIKAL

STEM PACKAGE

STEM A	STEM B	STEM C
PHYSIC CHEMISTRY BIOLOGY ADDITIONAL MATHEMATICS	ANY TWO(2) PURE SCIENCE SUBJECTS AND ADDITIONAL MATHEMATICS AND AT LEAST ONE(1) APPLIED SCIENCE & TECHNOLOGY STEM ELECTIVE	AT LEAST TWO (2) APPLIED SCIENCE & TECHNOLOGY STEM ELECTIVE OR ANY ONE (1) OF VOCATIONAL SUBJECTS

STEM Package
A

Taking all Pure Science Subjects (Physic, Chemistry, & Biology)

And

Additional Mathematics

EXAMPLE STEM_A1

CORE	COMPULSORY	ELECTIVE
- Bahasa Melayu - Bahasa Inggeris - Matematik - Sejarah - Pendidikan Islam/Pend. Moral **Pengecualian MP Sains*	- Pendidikan Jasmani & Pendidikan Kesihatan	- Physic - Chemistry - Biology - Additional Mathematics

EXAMPLE STEM_A2

CORE	COMPULSORY	ELECTIVE
- Bahasa Melayu - Bahasa Inggeris - Matematik - Sejarah **Pengecualian MP Pend. Islam dan Sains*	- Pendidikan Jasmani & Pendidikan Kesihatan	- Physic - Chemistry - Biology - Additional Mathematics - Bahasa Arab - Pend. Al-Quran dan Ass-Sunnah - Pend. Syariah Islamiah

EXAMPLE STEM_A-3

CORE	COMPULSORY	ELECTIVE
- Bahasa Melayu - Bahasa Inggeris - Matematik - Sejarah - Pendidikan Islam/Pend. Moral **Pengecualian MP Sains*	Pendidikan Jasmani & Pendidikan Kesihatan	- Physic - Chemistry - Biology - Additional Mathematics - Bahasa Cina

STEM Package
B

Taking any TWO Pure Science and Additional Math

And
at least ONE elective Applied Science and technology

Or

ONE non-STEM elective

EXAMPLE STEM_B-1

CORE	COMPULSORY	ELECTIVE
- Bahasa Melayu - Bahasa Inggeris - Matematik - Sejarah - Pendidikan Islam/Pend. Moral **Pengecualian MP Sains*	- Pendidikan Jasmani & Pendidikan Kesihatan	- Additional Mathematics - Physic - Chemistry - Grafik Komunikasi Teknikal

EXAMPLE STEM_B-2

CORE	COMPULSORY	ELECTIVE
- Bahasa Melayu - Bahasa Inggeris - Matematik - Sejarah - Pendidikan Islam/Pend. Moral **Pengecualian MP Sains*	- Pendidikan Jasmani & Pendidikan Kesihatan	- Additional Mathematics - Physic - Chemistry - Pengajian Kejuruteraan Awam - Lukisan Kejuruteraan

EXAMPLE STEM_B-3

CORE	COMPULSORY	ELECTIVE
- Bahasa Melayu - Bahasa Inggeris - Matematik - Sejarah - Pendidikan Islam/Pend. Moral **Pengecualian MP Sains*	Pendidikan Jasmani & Pendidikan Kesihatan	- Additional Mathematics - Biology - Physic - Sains Sukan

STEM Package C

Taking at least TWO Elective Applied Science and Technology

OR

any ONE of the Vocational subjects.

EXAMPLE STEM_C1

CORE	COMPULSORY	ELECTIVE
- Bahasa Melayu - Bahasa Inggeris - Matematik - Sains - Sejarah - Pendidikan Islam/Pend. Moral	- Pendidikan Jasmani & Pendidikan Kesihatan	- Sains Komputer - Reka Bentuk - Pendidikan Seni Visual

EXAMPLE STEM_C2

CORE	COMPULSORY	ELECTIVE
- Bahasa Melayu - Bahasa Inggeris - Matematik - Sains - Sejarah - Pendidikan Islam/Pend. Moral	- Pendidikan Jasmani & Pendidikan Kesihatan	- Rumah Tangga - Sains Komputer - Ekonomi - Perniagaan

EXAMPLE STEM_C3

CORE	COMPULSORY	ELECTIVE
- Bahasa Melayu - Bahasa Inggeris - Matematik - Sains - Sejarah - Pendidikan Islam/Pend. Moral	Pendidikan Jasmani & Pendidikan Kesihatan	- Produksi Reka Tanda

Enrolment of Students in STEM

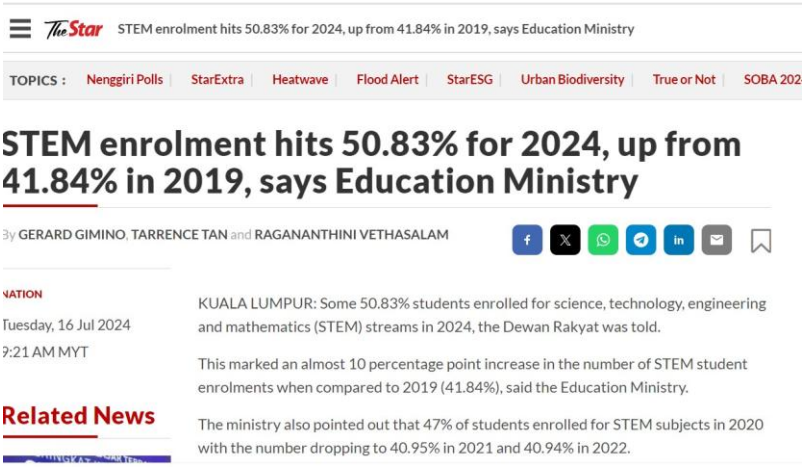
- Education Minister has announced that students' enrolment in STEM has increased from **40.95%** in 2021 to **45.73%** in 2023.

  (source: Awani 19 Oct. 2023, The Star, 16 July 2024).

- STEM enrolment has increased to **50.83%** in 2024 from **41.84%** in 2019.

  (source: The Star, 16 July 2024).

Enrolment of Students in STEM Subjects



The Star STEM enrolment hits 50.83% for 2024, up from 41.84% in 2019, says Education Ministry

TOPICS : Nenggiri Polls | StarExtra | Heatwave | Flood Alert | StarESG | Urban Biodiversity | True or Not | SOBA 202

STEM enrolment hits 50.83% for 2024, up from 41.84% in 2019, says Education Ministry

By GERARD GIMINO, TARRENCE TAN and RAGANANTHINI VETHASALAM

NATION

Tuesday, 16 Jul 2024

9:21 AM MYT

Related News

KUALA LUMPUR: Some 50.83% students enrolled for science, technology, engineering and mathematics (STEM) streams in 2024, the Dewan Rakyat was told.

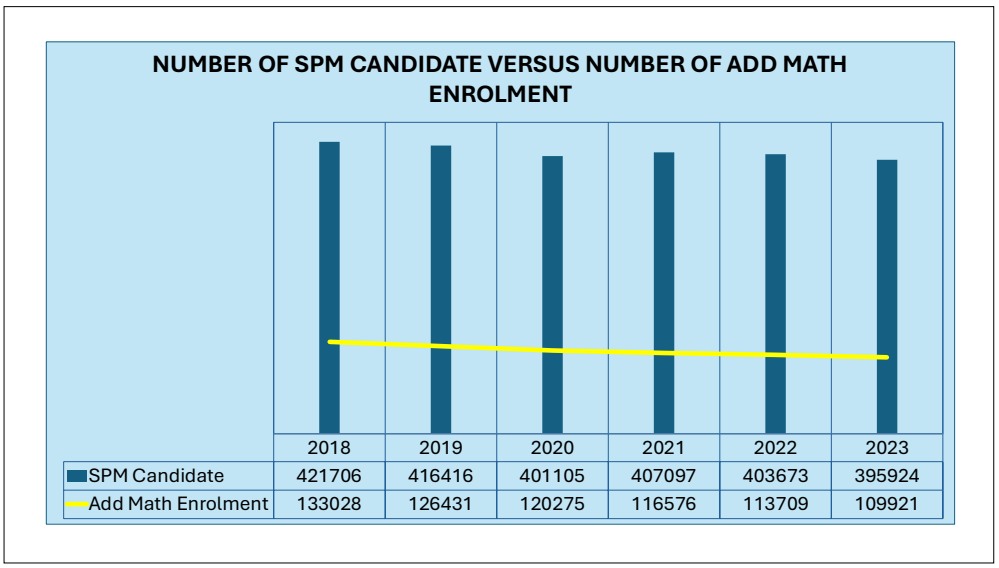
This marked an almost 10 percentage point increase in the number of STEM student enrolments when compared to 2019 (41.84%), said the Education Ministry.

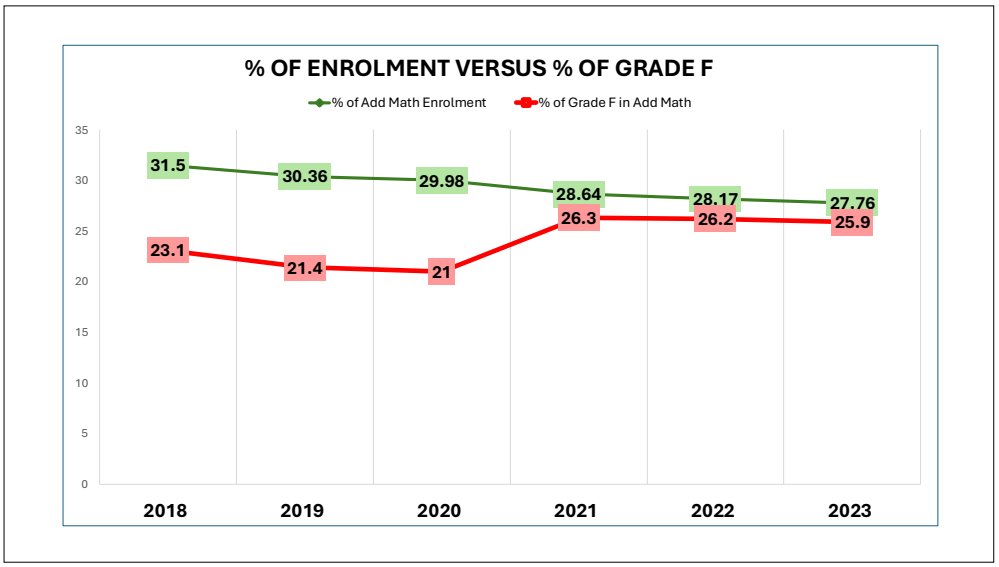
The ministry also pointed out that 47% of students enrolled for STEM subjects in 2020 with the number dropping to 40.95% in 2021 and 40.94% in 2022.

Additional Mathematics Enrolment (SPM) (2018 – 2023)

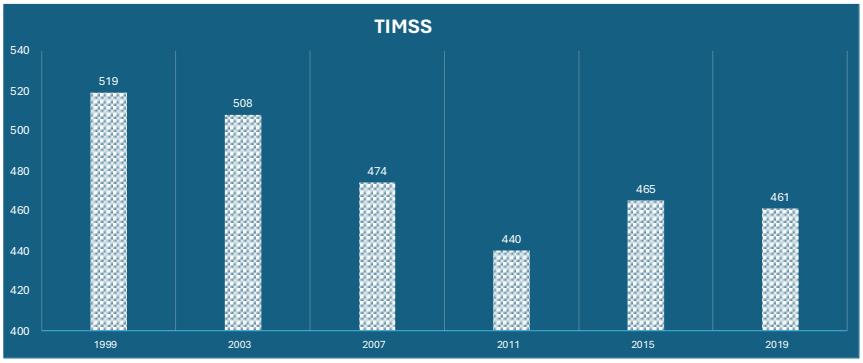
SUBJECT	YEAR	ENROLMENT	% OF ENROLMENT	GRADE F (%)
ADDITIONAL MATHEMATICS	2018	133,028 (421,706)	31.50	23.1
	2019	126,431 (416,416)	30.36	21.4
	2020	120,275 (401,105)	29.98	21.0
	2021	116,576 (407,097)	28.64	26.3
	2022	113,709 (403,673)	28.17	26.2
	2023	109,921 (395,924)	27.76	25.9

( ) TOTAL SPM CANDIDATE


NUMBER OF SPM CANDIDATE VERSUS NUMBER OF ADD MATH ENROLMENT
2018 2019 2020 2021 2022 2023
SPM Candidate 421706 416416 401105 407097 403673 395924
Add Math Enrolment 133028 126431 120275 116576 113709 109921


% OF ENROLMENT VERSUS % OF GRADE F
% of Add Math Enrolment
% of Grade F in Add Math
35
30
25
20
15
10
5
0
31.5
30.36
29.98
28.64
28.17
27.76
23.1
21.4
21
26.3
26.2
25.9
2018
2019
2020
2021
2022
2023

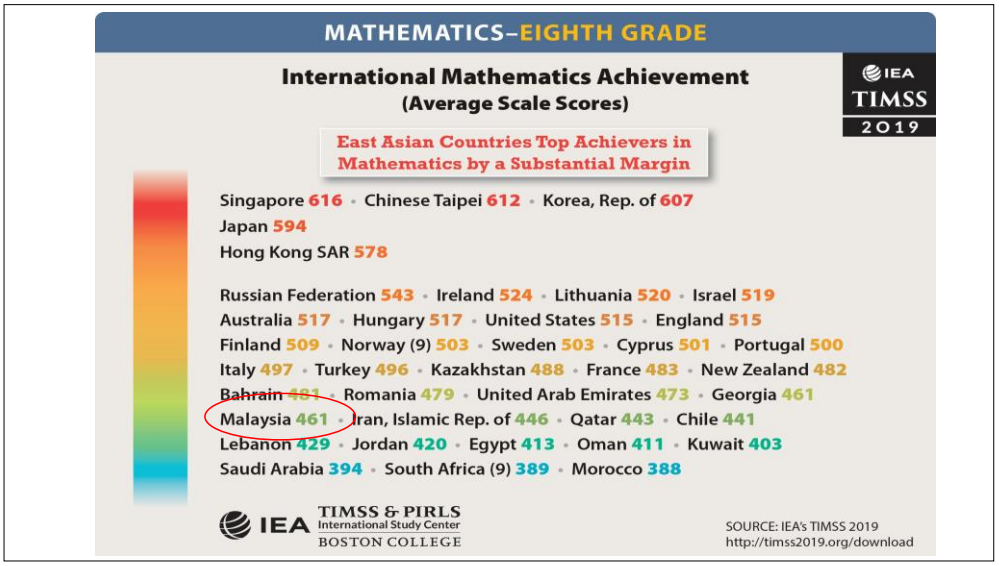
Trend in International Mathematics and Science Study (TIMSS)

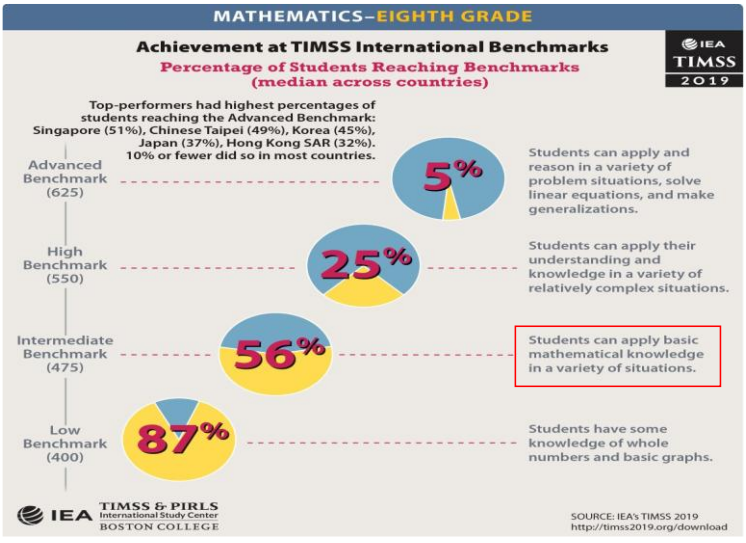


TIMSS 2019 Mathematics Content and Cognitive Domains

- The group of students involved was in form 2.
- TIMSS is conducted every 4 years starting in 1995 and Malaysia started to participate in 1999.
- TIMSS 2019 assessed four content areas in mathematics: **number, algebra, geometry, and data and probability.**
- Students were asked **to solve real world problems** using algebraic models and explain relationships involving algebraic concepts.

Sources: IEA's TIMSS 2019


MATHEMATICS–EIGHTH GRADE
International Mathematics Achievement
(Average Scale Scores)
IEA TIMSS 2019
East Asian Countries Top Achievers in Mathematics by a Substantial Margin
Singapore 616 • Chinese Taipei 612 • Korea, Rep. of 607
Japan 594
Hong Kong SAR 578
Russian Federation 543 • Ireland 524 • Lithuania 520 • Israel 519
Australia 517 • Hungary 517 • United States 515 • England 515
Finland 509 • Norway (9) 503 • Sweden 503 • Cyprus 501 • Portugal 500
Italy 497 • Turkey 496 • Kazakhstan 488 • France 483 • New Zealand 482
Bahrain 481 • Romania 479 • United Arab Emirates 473 • Georgia 461
Malaysia 461 • Iran, Islamic Rep. of 446 • Qatar 443 • Chile 441
Lebanon 429 • Jordan 420 • Egypt 413 • Oman 411 • Kuwait 403
Saudi Arabia 394 • South Africa (9) 389 • Morocco 388
IEA TIMSS & PIRLS International Study Center BOSTON COLLEGE
SOURCE: IEA's TIMSS 2019
http://timss2019.org/download


MATHEMATICS–EIGHTH GRADE
Achievement at TIMSS International Benchmarks
Percentage of Students Reaching Benchmarks
(median across countries)
IEA TIMSS 2019
Top-performers had highest percentages of students reaching the Advanced Benchmark: Singapore (51%), Chinese Taipei (49%), Korea (45%), Japan (37%), Hong Kong SAR (32%). 10% or fewer did so in most countries.
Advanced Benchmark (625)
5%
Students can apply and reason in a variety of problem situations, solve linear equations, and make generalizations.
High Benchmark (550)
25%
Students can apply their understanding and knowledge in a variety of relatively complex situations.
Intermediate Benchmark (475)
56%
Students can apply basic mathematical knowledge in a variety of situations.
Low Benchmark (400)
87%
Students have some knowledge of whole numbers and basic graphs.
IEA TIMSS & PIRLS International Study Center BOSTON COLLEGE
SOURCE: IEA's TIMSS 2019
http://timss2019.org/download

ISSUES

- Downward trend in Additional Mathematics enrolment from 2018 until 2023.
- Failure rate is worrying (more than 25% failure rate).
- STEM C does not offer Additional Mathematics subject and even Pure Science subject is not there.
- Looking at the TIMSS results, our lower secondary students are not doing well as compared to our neighbouring countries for the pass many years since 1999. Does this contribute to low enrolment in Additional Math and worrying failure rate of Add Math?
- Our lower secondary students **barely achieved Intermediate Benchmark**: **Students can apply basic mathematical knowledge in a variety of situations**.
- How do we strategize in order for our students to have sound background in Mathematics and able to connect mathematics to real world problems? Thus, this require reshaping the STEM education curriculum so that we can reposition mathematics as an essential key player within transdisciplinary STEM education.

THANK YOU

Mathematical Sciences Research: Challenges in Industrial Innovations

Associate Professor Dr. Arifah Bahar
UTM Centre for Industrial and Applied Mathematics
Universiti Teknologi Malaysia
Johor Bahru, Johor.
Akademi Ilmuwan Sains Matematik Malaysia
(AISMM)

Abstract

The presentation "Mathematical Sciences Research: Challenges in Industrial Innovations" highlights the pivotal role of Mathematical Sciences in driving industrial innovation and shaping the proposed policy. It delves into the essential criteria for Mathematical Sciences education, emphasizing the need for a balanced curriculum design that combines depth in specialized fields with breadth across disciplines. The discussion highlights the importance of research excellence to achieve global recognition for Malaysian Mathematical Sciences and its industrial impact.

Challenges such as funding limitations, effective integration with industry needs, and the commercialization of mathematical innovations are explored. The presentation proposes strategies to enhance graduate employability, foster public-private partnerships, and promote a research culture that aligns academic and industrial goals. Additionally, it advocates for modernizing educational objectives and fostering diversity in Mathematical Sciences programmes to cultivate talent and ensure inclusivity.

This comprehensive examination provides a foundation for formulating the Malaysian Mathematical Sciences Policy, aiming to bridge the gap between academic achievements and real-world industrial applications.

AISMM
AKADEMI ILMUWAN SAINS MATEMATIK MALAYSIA
(MALAYSIAN ACADEMY OF MATHEMATICAL SCIENTISTS)

ROUNDTABLE DISCUSSION:
FORMULATION OF THE MALAYSIAN MATHEMATICAL SCIENCES POLICY

Mathematical Sciences Research: Challenges in Industrial Innovations.

Arifah Bahar
AISMM
UTM – CIAM

Outline

- Criteria - Concept of Mathematical Sciences
- Curriculum
- Research
- Innovation
- Commercialisation

2

Criteria

- Concept of Mathematical Sciences
  - Depth and breadth of the mathematical sciences content

    The undergraduate mathematical sciences major should have a certain amount of depth in **one specialised area of mathematical sciences** and reasonable breadth across areas of the mathematical sciences: **However, how much is much?** MQA has only given a general guideline that might mislead some higher education providers. For example Data Science has been classified under Computer science related Faculty not Mathematical Sciences Dept or School
    - Can be observed or assessed through
      - the student's understanding of the context and applications of the mathematical sciences
      - student's ability to communicate mathematical or statistical concepts or results to both specialists and lay people
      - facility provided with appropriate information technology and professional software
  - Mathematical sciences department' role in handling different students backgrounds
    - should develop practical strategies to deal with the diversity of background (ethnics and financial)
    - should design strategies in handling students with prior mathematical achievement and to increase the attractiveness of continuing mathematics and statistics study to all students.
  - Quality of graduates
    - high proportion of graduates employed with premium employment and to do research at higher degrees
    - Challenge – adequate funding for students to continue their research

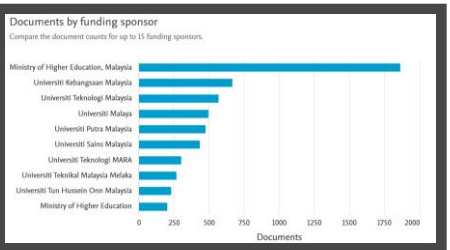
3

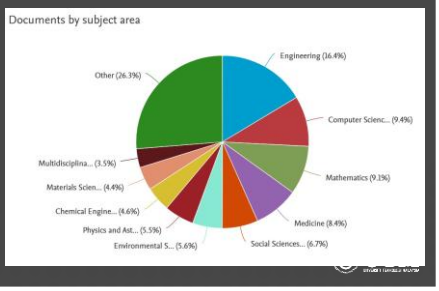
Research

- Highest Level of Excellence in Mathematical Sciences Research
  - to achieve local and Global Impact for Malaysian Research in the Mathematical Sciences
    - Funding is required - to promote the significant of the mathematical sciences bringing positive impact to the industry
- Encourage dialog with appropriate bodies for broader participation by mathematical scientists in strategic projects by government or industries.
- Partner with the private and government agencies in supporting the recruitment and training of young people in the mathematical sciences.
- Funding agencies need to be friendlier to mathematical sciences research project

4

Simple Trend of Successful Applications of FRGS from an RU (all domains)





Basic Analysis from Scopus Database for mathematical sciences keywords for documents published in Scopus database from 2000 – 2023

Issues/Challenges

Curriculum

- Too applied or with application approach
- Does not lead to good communication skill
- Modern educational goals

Innovation

- Difficult to understand - how can help the innovators
- The mathematician deep thinking - beyond future

Research

- Arts and science combined
- Manipulation of 'usable maths'
- Statistics as the 'front-end' subject
- Fundamental research misconception - different values for academia and industries

Commercialisation

- Slow growth
- Less budget allocated
- 'Uncalculated' risk

STRATEGIC THRUSTS

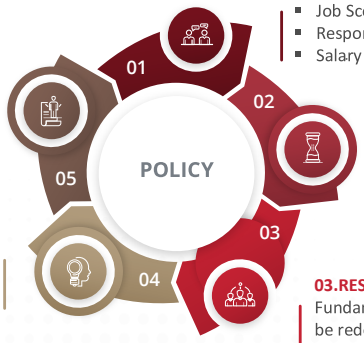
01. TALENT
- Job Scope
- Responsibility/Professionalism
- Salary

02. CURRICULUM
- Fundamental – ease of access to be applied or apply
- Modern Education Goal as a tool

03.RESEARCH
Fundamental research need to be redefined in such a way that it is worth researching and requires funding.

04.INNOVATION
Mathematical formulation as part of mathematical innovation potential to be commercialized – need to be handled together with industries.

05. COMMERCIALISATION
Academia – industry – government identify suitable business model to commercialise potential products (from idea or algorithm or smart model).



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AKADEMI ILMUWAN SAINS MATEMATIK MALAYSIA
(MALAYSIAN ACADEMY OF MATHEMATICAL SCIENTISTS)

THANK YOU

Spearheading Malaysia's Technological Transformation through Mathematical Excellence

Professor (R) Dr. Norsarahaida Saidina Amin
Department of Mathematical Sciences
Faculty of Science
Universiti Teknologi Malaysia
Johor Bahru, Johor.
Akademi Ilmuwan Sains Matematik Malaysia (AISMM)

Abstract

This presentation explores Malaysia's journey toward becoming a high-technology nation through strategic development and application of mathematical excellence. With a historical review of industrialization policies from the 1960s to current initiatives like Industry-4WRD and the Shared Prosperity Vision 2030, the presentation highlights the pivotal role Mathematical Sciences plays in technological advancement. It emphasizes the need for mathematical scientists to engage in interdisciplinary and transdisciplinary work alongside scientists and engineers, addressing complex industrial challenges. Current issues, including limited communication skills, lack of dedicated Mathematical Sciences faculties, and insufficient curriculum standards, are analyzed.

A comprehensive framework is proposed to strengthen mathematical education, foster research and innovation, and ensure real-world applications, supporting a seamless integration with Malaysia's technological goals. The presentation advocates for robust policy, institutional support, and collaboration between academia and industry. It also emphasizes the importance of building a culture of mathematical excellence, capable of driving progress in areas such as data science, cybersecurity, and algorithm development, which are critical for Malaysia's transformation and sustainability in the global tech landscape.

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UNIVERSITI TEKNOLOGI MALAYSIA

ROUNDTABLE DISCUSSION: FORMULATION OF NATIONAL MATHEMATICAL SCIENCES POLICY

Spearheading Malaysia's Technological Transformation through Mathematical Excellence

Norsarahaida Amin
Professor (R),
Dept. of Mathematical Sciences,
UTM, Johor Bahru.
AISMM

innovative • entrepreneurial • global

Abstract

Spearheading Malaysia's Technological Transformation through Mathematical Excellence

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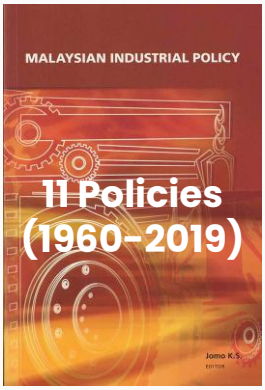

1. Malaysia's Industrialization Policies

- Malaysia aspires to become a high-technology nation with an economy driven by the development and application of science and technology.
- It seeks to transform from a nation of consumers to one that develops and applies technology.
- This requires a policy statement with well-thought-out strategies, action plans, and initiatives to ensure efforts remain on track for success.

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Timeline for major initiatives (11 over 30 years)

Malaysia's Industrialization Policies

1. Import Substitution Industrialization (1960s)
2. New Economic Policy (NEP) - 1971–1990
3. Heavy Industrialization Policy (HIP) - 1980
4. Look East Policy – 1982
5. Industrial Masterplan I – 1986-1995
6. Industrial Masterplan II – 1996-2005

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Malaysia's Industrialization Policies

Timeline for major initiatives (11 over 30 years)

7. Vision 2020 (Wawasan 2020) – 1991 (Make Malaysia a fully industrialized nation by 2020)
8. Multimedia Super Corridor – 1996
9. Third Industrial Masterplan – 2006-2020
10. National Policy on Industry 4.0 (Industry4WRD) – 2018
11. Shared Prosperity Vision 2030 (SPV 2030) – 2019

- *These policies represent key milestones in Malaysia's industrialization efforts, transitioning from basic industries in the 1960s to more advanced, high-tech, and knowledge-based industries today.*

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Malaysia's Industrialization Policies

01 **1960s**
Import Substitution Industrialization

02 **1971-1990**
New Economic Policy (NEP)

03 **1980**
Heavy Industrialization Policy (HIP)

04 **1982**
Look East Policy

05 **1986-1995**
Industrial Masterplan I

06 **1996-2005**
Industrial Masterplan II

07 **1991**
Vision 2020 (Wawasan 2020) Make Malaysia a fully industrialized Nation by 2020

08 **2006-2020**
Multimedia Super Corridor

09 **2006-2020**
Industrial Masterplan III

10 **2018**
National Policy on Industry 4.0 (Industry4WRD)

11 **2019**
Shared Prosperity Vision 2030 (SPV 2030)

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PMX quotes on Artificial Intelligence

- Prime Minister Anwar Ibrahim has emphasized the importance of mastering Artificial Intelligence (AI) for Malaysia's future, particularly in determining the cultural and moral values embedded in AI systems.

- AI as crucial across multiple sectors, including government, defense, and the private sector

- the mastery of AI as essential for maintaining sovereignty and advancing the nation

- reiterated that AI will play a dominant role in the future of governance, security, and business

- supported the establishment of AI research institutions, such as the Faculty of Artificial Intelligence at Universiti Teknologi Malaysia, as part of his vision for Malaysia to stay competitive in the global technological race

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2. Technological transformation must be driven by mathematical excellence

- Mathematical excellence is the engine powering technological advancements
- What constitutes mathematical excellence that drive technological transformation
- Top-notch mathematicians who can discover new knowledge, and adaptable to ensure the success of both interdisciplinary and transdisciplinary assignments
- How do we enhance our skills to equip and upgrade ourselves with new knowledge to discover other new knowledge
- able to work in both interdisciplinary and transdisciplinary team – Work in tandem with scientists, technologists and engineers to solve multifaceted problems arisen from industries (STEM in action).
- Possess good communication skills to promote mathematical literacy across the board from policy makers, to industry and the general population

In the context of current, practicing Malaysian mathematicians, what are the issues and challenges

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3. Issues and Challenges

- General profile of Malaysian Mathematicians - timid, work in silos, lack communication skills
- Institutional demands and policies on performance (KPI's, jack of all trade),
- Education policy -insufficient feeders (Stem A / B /C)
- Policy on TVET intake
- Lack of Coordination – academic and non-academic activities
- Resources are not optimized and shared
- Lack of trust from industry
- Management of mathematical sciences issues – maths not having own faculty – difficult to manage problems specific to mathematicians
- Curriculum – no quality standard for mathematics
- Awards and accolades – mathematicians are often sidelined

9

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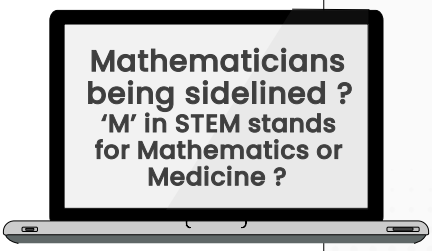

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4. A robust framework for achieving mathematical excellence to support technology transformation

***Key pillars*:**
strengthening education, fostering research, encouraging interdisciplinary collaboration and ensuring real world applications of mathematics.

- Strengthening Mathematical Education
  - Early Education
  - Curriculum Modernization
  - STEM Focus
- Research and Innovation in Mathematical Sciences
  - Government and Industry Support for Research
  - Interdisciplinary Research

- Institutional Support and Collaboration
  - Centers of Excellence
  - University-Industry Collaboration
- Applications of Mathematics in Technology
  - Algorithm Development and Optimization
  - Data Science and Analytics
  - Cryptography and Cybersecurity
- Global Collaboration and Knowledge Sharing
  - Conferences and Workshops
  - Open Access to Research
- Building a Culture of Mathematical Excellence
  - Public Awareness and Engagement
  - Encouraging Problem Solving Competitions

Table 1
Policies that Support STEM in Malaysia

National Policy	Implementation Period (Year)
National Science, Technology, and Innovation Policy	2021-2030
National Space Policy	2030
National Robotics Roadmap	2021-2030
National Biotechnology Policy 2.0	2022-2030
National Blockchain Roadmap	2021-2030
Electrical & Electronics Roadmap: Technology Development	2021-2030
Advanced Technology Materials Roadmap	2021-2030
National Nano Technology and Product Roadmap	2021-2025
Artificial Intelligence Roadmap	2021-2025
Malaysian Startup Ecosystem Roadmap	2021-2030
Fourth Industrial Revolution (4IR) National Policy	2030
Shared Prosperity Vision 2030 (SPV2030)	2030

(Sources: *Ministry of Science, Technology, and Innovation*, 2022)

Policies that support STEM

- NIMP 2030 New Industrial Master Plan - to transform Malaysia into high-tech industrialized nation – Ministry of Investment, Trade and Industry
- DSTIN / NSITP 2021 -2030 will strengthen the development and use of advanced technology , setting the goal to transform industry and society , from technology users to technology developers

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5. Proposed Policy Statement on Mathematical Sciences

I. Giving all Malaysian school students, within the National Education System in Malaysia, access to a school's ecosystem with outstanding mathematics teachers, well developed curriculum in Mathematics & Statistics and excellent infrastructure for teaching and learning.

I. Strengthen all Levels of Mathematical Sciences Education.
(Guaranteeing Highest Standards of Mathematical Sciences Teaching at Malaysian Tertiary Institutions)

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III. Maintain the Highest Level of Excellence in Mathematical Sciences Research.
(Achieving Both Local and Global Authoritative Impact for Malaysian Research in the Mathematical Sciences Community)

III. Unite the Power of Mathematical Sciences and Mathematical Thinking to Resolve Problems in Science, Technology, Engineering and Society.
(Ensuring that Malaysian Society is Ever Ready to Capture the Benefits of New Mathematical Sciences-Based Technologies

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Critical Components To Be Addressed :

Well-Defined Policy Statement

Strategic Planning

Implementation Initiatives

Stakeholder Engagement

Monitoring and Evaluation -

Regular monitoring and evaluation are crucial to track progress and make adjustments as needed.

This helps ensure that the efforts remain focused and aligned with the overall goals.

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* Establish a body that regulates, monitors, and evaluates progress, tracks and make adjustments as needed. This is to ensure that the efforts remain focused and aligned with the overall goals *

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ACKNOWLEDGEMENTS

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Report on Formulation of the Malaysian Mathematical Sciences Policy: Issues and Challenges

Introduction

This report summarizes the key points discussed during the Roundtable Discussion on "***Dasar Sains Matematik Negara (Malaysian Mathematical Sciences Policy)***" held on 9 September 2024 at the International Seminar on Mathematics in Industry 2024 (ISMI2024) in Concorde Hotel, Kuala Lumpur. The roundtable aimed to facilitate an in-depth and meaningful dialogue on the future of Mathematical Sciences in Malaysia. It is focused on developing a national policy that strengthens education, fosters innovation, and enhances global competitiveness in Mathematical Sciences and related fields. The session was moderated by Professor (R) Dato' Dr. Mohd Ismail Abd Aziz from MYHIMS Solutions PLT. Contributors include Professor Dr. Ibrahim Mohamed (Universiti Malaya), Professor Dr. Hailiza Kamarulhaili (Universiti Sains Malaysia), Associate Professor Dr. Arifah Bahar (Universiti Teknologi Malaysia), Professor (R) Dr. Norsarahaida Saidina Amin (Akademi Ilmuan Sains Matematik Malaysia-AISMM), Professor (R) Dr. Arsmah Ibrahim (Universiti Teknologi Mara) and Professor Fumikazu Sato (Kyushu University).

The discussions highlighted several main areas of concern including: the decline in STEM enrolment and public perception, education system challenges, gaps between school and university-level mathematics, and the need for a unified approach to elevate the field's role in Malaysia's technological advancement.

Key Discussion Points:

Decline in STEM Enrollment and Public Perception

It is observed that there is a decline in students pursuing STEM subjects, particularly in advanced mathematics. This decline is further intensified by public perceptions of mathematics as overly challenging and disconnected or not aligned with current career pathways. The panel noted that Malaysia's current three-tiered STEM elective structure—comprising STEM A (pure

science and additional mathematics), STEM B (applied science and technology), and STEM C (vocational)—leaves out essential subjects such as Additional Mathematics and Pure Science in the vocational track.

As a result, enrolment in advanced mathematics courses has steadily declined, with a significant rise in failure rates, especially in Additional Mathematics. According to TIMSS 2019, Malaysian students are generally underperforming in fundamental mathematical areas such as number, algebra, geometry, and data and probability, often struggling to apply basic mathematical skills in real-world contexts.

While the panel acknowledged a modest increase in overall STEM enrolment in 2024, the persistent decline in participation and performance in Additional Mathematics remains a critical issue. The growing percentage of students receiving grade F in this subject further highlights the challenge, which impacts student motivation and poses risks to Malaysia's long-term prospects in STEM-related fields.

Challenges in Educational Approaches and Resources

The quality of mathematics education at the primary and secondary levels emerged as a significant concern. The curriculum is widely perceived as overly advanced and misaligned with students' age and developmental stages, which, coupled with inadequate assessments, has dampened student interest and achievement. Comparisons with top-performing countries like Singapore, Japan, and Finland highlighted that these countries' approaches to education, including flexible curricula and differentiated goals, could offer valuable insights for Malaysian reform. For instance, Finland's group-based learning model, alongside its rigorous teacher qualifications and professional development focus, contrasts sharply with Malaysia's standardized curriculum, which lacks the flexibility to align with students' developmental needs.

The panel emphasized that addressing these issues requires a multifaceted approach, particularly in enhancing teacher's expertise and support. Programmess like the UK's School Partnership Program and Japan's Kaizen-based model of continuous improvement were cited as effective frameworks to improve instructional quality and foster professional growth. Equally

important, the panelist highlighted the need for increased investment in teaching resources, including digital tools, computers, and lab facilities, as well as streamlining teacher responsibilities so educators can dedicate more time to student development. Additionally, to create a more supportive learning environment, they advocated for policies allowing teachers sabbatical leave and limiting their administrative and technical workloads, enabling a greater focus on instruction and mentorship.

To further strengthen the educational landscape, the panel called for enhanced partnerships with alumni, local industries, and external organizations. These connections could bridge the gap between theoretical learning and practical application, making mathematics more relevant and appealing to students by linking it to viable career pathways and industry needs.

Disconnect Between School and University: Curriculum Misalignment, and Research Funding

A noted gap exists between school-level and university-level mathematics in Malaysia, which has left students ill-prepared for the rigor of advanced mathematics at the tertiary level. The panelist discussed the importance of streamlining the Mathematical Sciences curriculum to cover a balanced range of topics that reflect both depth and breadth. Currently, some crucial areas, like data science, are either loosely categorized or inadequately integrated into the curriculum, leading to an uneven emphasis across Mathematical Sciences disciplines. This inconsistency impacts students' understanding and reduces their ability to develop a comprehensive grasp of the subject, particularly for those aiming to pursue Mathematical Sciences at the university level.

Addressing this disconnect, it is suggested that Mathematical Sciences departments at universities develop more targeted strategies to accommodate students who lack strong foundations in additional mathematics. Such strategies could include preparatory programs and curriculum adjustments designed to facilitate smoother transitions into higher education.

Research in Mathematical Sciences also requires greater attention and funding to highlight the discipline's significance in driving positive societal impact. Dialogue with appropriate bodies, including private and government agencies, should be encouraged to foster collaboration and secure funding for research initiatives. The panel highlighted concerns with the current research landscape, particularly the low success rates in publications arising from FRGS (Fundamental Research Grant Scheme). This issue is further complicated by difficulties in applying mathematical concepts to innovative solutions, and misconceptions around the use of mathematical and statistical methods in research.

To address these challenges, the panel advocated for a more balanced Mathematical Sciences curriculum that includes both depth and breadth. They also recommended stronger collaborations between academic institutions and the private sector to align educational outputs with the demands of the modern workforce, particularly in fields such as data science.

Unified National Policy on Mathematical Sciences

The lack of a cohesive national strategy for Mathematical Sciences was a central discussion point. Malaysia has implemented numerous educational and industrial policies over the past several decades, including Vision 2020 and the Multimedia Super Corridor, yet none have consistently integrated the role of Mathematical Sciences. The absence of mathematical scientists involved in the formulation of these policies has limited the country’s ability to leverage Mathematical Sciences for industrial and economic progress. With Mathematical Sciences recognized as essential to innovation in the digital age, it is emphasized the urgent need for a dedicated National Policy on Mathematical Sciences, which would align educational, industrial, and governmental objectives.

Challenges to producing elite mathematical scientists were also highlighted, with participants noting that the heavy teaching workload and inadequate understanding of STEM’s value among academicians have detracted from advancing the field. It was proposed that a specific governing body be established to advocate for the Mathematical Sciences, ensuring that policies are evidence-based and that mathematical scientists have a visible presence

in policy discussions. A consensus emerged that a national policy could facilitate multidisciplinary collaboration, secure funding for research and innovation, and position Mathematical Sciences as a cornerstone of Malaysia's future technological ambitions.

Other Views

Professor Sato from Kyushu University, drawing on his extensive experience across various Japanese ministries, highlighted the data-driven philosophy underlying Japan's educational reforms. He explained that the Japanese government emphasizes using data to guide decisions at every educational level, from primary to secondary school, aligning this approach with the vision of creating "Society 5.0." This forward-thinking model aims to integrate advanced technologies throughout all sectors, including education, to build an innovative and inclusive society. Through ongoing observation and assessment, Japan's education system actively cultivates skills essential for success in the digital age and beyond.

It is also suggested that Malaysian mathematical scientists engage more directly with political leaders to highlight Mathematical Sciences' role in shaping policy. Increasing mathematical scientist' visibility in the community was also recommended to strengthen their influence in public discourse and policy advocacy.

Additional comments urged caution in adopting foreign strategies wholesale, stressing the importance of adapting successful policies to fit local needs rather than replicating them verbatim. The discussion underscored the value of a unified education policy but stressed that flexibility is key to addressing diverse national challenges.

The audience also discussed the rigor of STEM initiatives, questioning how stringent efforts should be in fostering STEM education and the tangible impact of these efforts on the broader community. It was suggested that better coordination between Mathematical Sciences organizations could enhance the effectiveness of STEM activities and ensure a more cohesive approach to their implementation.

Conclusions

The roundtable discussion highlighted key areas essential for advancing Mathematical Sciences in Malaysia, focusing on addressing enrolment challenges, improving educational quality, bridging curriculum gaps, and establishing a cohesive national policy. Addressing the persistent decline in STEM interest, especially in advanced mathematics, was a major priority, with discussions on curriculum restructuring and enhanced teaching resources suggested to make Mathematical Sciences more engaging and relevant for students. The need for curriculum alignment between school and university levels was also emphasized, with targeted initiatives proposed to ensure students transition smoothly into advanced mathematics at the tertiary level.

Moreover, participants highlighted the absence of a unified national policy on Mathematical Sciences as a barrier to effectively leveraging Mathematical Sciences in Malaysia's economic and technological development. Calls were made for a dedicated governing body to advocate for Mathematical Sciences, facilitating cross-sector collaboration and evidence-based policy formulation. Drawing inspiration from Japan's data-driven "Society 5.0" vision, the session concluded with a call for a flexible, locally adapted approach to policy that recognizes Mathematical Sciences as a foundation for Malaysia's future competitiveness and innovation in a rapidly evolving digital landscape.

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13 November 2024, Concorde Hotel Kuala Lumpur.

ISMI 2024 International Seminar on Mathematics in Industry 2024

Mathematical Evolution Guiding Industrial Innovation Futures